

# 对引力形式的方程组的猜测

黄山

(芜湖职业技术学院， 安徽， 芜湖， 241003)

**摘要：**类比电磁形式的麦克斯韦方程组，我们找到一组看起来非常有趣的引力形式的方程组。

**关键词：**电荷，磁单极子，麦克斯韦方程组，万有引力常数。

电磁形式的麦克斯韦方程组依次等价于，

$$\begin{aligned}(\mathbf{E}) &= \frac{1}{(4\pi)(\epsilon_0)(\mathbf{r})^2} * (\varphi_B) = \frac{(2\pi)(\mathbf{i})^3(\varphi_E)^3}{(4\pi)^2(\mathbf{R}_\infty)^2(\varphi_B)^3(\mathbf{r})^2} * (\varphi_B) , \\ \Rightarrow &\left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{1}{(\epsilon_0)} * (\varphi_B) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{\partial \mathbf{B}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = 0 , \\ 4, (\nabla \times \mathbf{B}) = (\mu_0) * (\mathbf{J}_E) + \frac{1}{(c)^2} * \frac{\partial \mathbf{E}}{\partial t} , \end{array} \right. \\ \Rightarrow &\left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{1}{(\epsilon_0)} * (\varphi_B) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{1}{(\epsilon_0)} * (\mathbf{J}_B) - \frac{\partial \mathbf{B}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = -(\mu_0) * (\varphi_E) , \\ 4, (\nabla \times \mathbf{B}) = (\mu_0) * (\mathbf{J}_E) + \frac{1}{(c)^2} * \frac{\partial \mathbf{E}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{E}) = (c) * (\mathbf{B}) , (\mathbf{i}) * (\mathbf{J}_E) = (c) * (\mathbf{J}_B) , (\mathbf{i}) * (\varphi_E) = (c) * (\varphi_B) , \end{array} \right. \\ \Rightarrow &\left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{(2\pi)(\mathbf{i})^3(\varphi_E)^3}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^3} * (\varphi_B) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{(2\pi)(\mathbf{i})^3(\varphi_E)^3}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^3} * (\mathbf{J}_B) - \frac{\partial \mathbf{B}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = -\frac{(2\pi)(\mathbf{i})(\varphi_E)}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)} * (\varphi_E) , \\ 4, (\nabla \times \mathbf{B}) = \frac{(2\pi)(\mathbf{i})(\varphi_E)}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)} * (\mathbf{J}_E) - \frac{1}{(c)^2} * \frac{\partial \mathbf{E}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{E}) = (c) * (\mathbf{B}) , (\mathbf{i}) * (\mathbf{J}_E) = (c) * (\mathbf{J}_B) , (\mathbf{i}) * (\varphi_E) = (c) * (\varphi_B) , \end{array} \right.\end{aligned}$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{(i)}{(\varepsilon_0)(c)} * (\varphi_E) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{(i)}{(\varepsilon_0)(c)} * (\mathbf{J}_E) - \frac{(i)}{(c)} * \frac{\partial \mathbf{E}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = \frac{(i)}{(\varepsilon_0)(c)} * (\varphi_B) , \\ 4, (\nabla \times \mathbf{B}) = -\frac{(i)}{(\varepsilon_0)(c)} * (\mathbf{J}_B) - \frac{(i)}{(c)} * \frac{\partial \mathbf{B}}{\partial t} , \\ 5, (i) * (\mathbf{E}) = (c) * (\mathbf{B}) , (i) * (\mathbf{J}_E) = (c) * (\mathbf{J}_B) , (i) * (\varphi_E) = (c) * (\varphi_B) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{(i)(2\pi)(i)^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\varphi_E) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{(i)(2\pi)(i)^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\mathbf{J}_E) - \frac{(i)}{(c)} * \frac{\partial \mathbf{E}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = \frac{(i)(2\pi)(i)^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\varphi_B) , \\ 4, (\nabla \times \mathbf{B}) = -\frac{(i)(2\pi)(i)^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\mathbf{J}_B) - \frac{(i)}{(c)} * \frac{\partial \mathbf{B}}{\partial t} , \\ 5, (i) * (\mathbf{E}) = (c) * (\mathbf{B}) , (i) * (\mathbf{J}_E) = (c) * (\mathbf{J}_B) , (i) * (\varphi_E) = (c) * (\varphi_B) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, \partial^\alpha \partial_\alpha \mathbf{A}_\beta = -\frac{(i)}{(\varepsilon_0)(c)} \mathbf{J}_\beta , \\ 2, \partial^\alpha \mathbf{A}_\alpha = \frac{(i)}{(\varepsilon_0)(c)(c)^2} \mathbf{J}_\alpha , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, \partial^\alpha \partial_\alpha \mathbf{A}_\beta = -\frac{(i)(2\pi)(i)^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} \mathbf{J}_\beta , \\ 2, \partial^\alpha \mathbf{A}_\alpha = \frac{(i)(2\pi)}{(4\pi)(\mathbf{R}_\infty)^2} \mathbf{J}_\alpha , \end{array} \right.$$

那么，类比的话，以及考虑引力和电磁之间的关系，引力形式的方程组就可以有，

$$(\mathbf{D}) = \frac{(\mathbf{G}_N)}{(\mathbf{r})^2} * (\varphi_C) = \frac{(4\pi)(\mathbf{a}_0)^2(i)(\varphi_D)(2\pi)}{(\mathbf{r})^2(\varphi_C)} * (\varphi_C) ,$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = (4\pi)(\mathbf{G}_N) * (\varphi_C) , \\ 2, (\nabla \times \mathbf{D}) = -\frac{\partial \mathbf{C}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = 0 , \\ 4, (\nabla \times \mathbf{C}) = \frac{(4\pi)(\mathbf{G}_N)}{(c)^2} * (\mathbf{J}_D) + \frac{1}{(c)^2} * \frac{\partial \mathbf{D}}{\partial t} , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = (4\pi) (\mathbf{G}_N) * (\varphi_C) , \\ 2, (\nabla \times \mathbf{D}) = -(4\pi) (\mathbf{G}_N) * (\mathbf{J}_C) - \frac{\partial \mathbf{C}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = -\frac{(4\pi) (\mathbf{G}_N)}{(c)^2} * (\varphi_D) , \\ 4, (\nabla \times \mathbf{C}) = \frac{(4\pi) (\mathbf{G}_N)}{(c)^2} * (\mathbf{J}_D) + \frac{1}{(c)^2} * \frac{\partial \mathbf{D}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = \frac{(4\pi)^2 (\mathbf{a}_0)^2 (\mathbf{i}) (\varphi_D) (2\pi)}{(\varphi_C)} * (\varphi_C) , \\ 2, (\nabla \times \mathbf{D}) = -\frac{(4\pi)^2 (\mathbf{a}_0)^2 (\mathbf{i}) (\varphi_D) (2\pi)}{(\varphi_C)} * (\mathbf{J}_C) - \frac{\partial \mathbf{C}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = -\frac{(4\pi)^2 (\mathbf{a}_0)^2 (\varphi_C) (2\pi)}{(\mathbf{i}) (\varphi_D)} * (\varphi_D) , \\ 4, (\nabla \times \mathbf{C}) = \frac{(4\pi)^2 (\mathbf{a}_0)^2 (\varphi_C) (2\pi)}{(\mathbf{i}) (\varphi_D)} * (\mathbf{J}_D) + \frac{1}{(c)^2} * \frac{\partial \mathbf{D}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = \frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\varphi_D) , \\ 2, (\nabla \times \mathbf{D}) = -\frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\mathbf{J}_D) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{D}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = \frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\varphi_C) , \\ 4, (\nabla \times \mathbf{C}) = -\frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\mathbf{J}_C) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{C}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = (\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\varphi_D) , \\ 2, (\nabla \times \mathbf{D}) = -(\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\mathbf{J}_D) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{D}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = (\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\varphi_C) , \\ 4, (\nabla \times \mathbf{C}) = -(\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\mathbf{J}_C) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{C}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, \partial^\gamma \partial_\gamma \mathbf{A}_\delta = -\frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} \mathbf{J}_\delta , \\ 2, \partial^\gamma \mathbf{A}_\gamma = \frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)(c)^2} \mathbf{J}_\gamma , \end{array} \right.$$

$$\Rightarrow \begin{cases} 1, \partial^\gamma \partial_\gamma \mathbf{A}_\delta = - \frac{(\mathbf{i})(4\pi)^2 (2\pi)^2 (\mathbf{a}_0)^2}{(2\pi)} \mathbf{J}_\delta , \\ 2, \partial^\gamma \mathbf{A}_\gamma = \frac{(\mathbf{i})(4\pi)^2 (2\pi)^2 (\mathbf{a}_0)^2 (\varphi_C)^2}{(2\pi)(\mathbf{i})^2 (\varphi_D)^2} \mathbf{J}_\gamma , \end{cases}$$

参考文献: <https://doi.org/10.5281/zenodo.6408584>。

# Guess about the equations in the form of gravity

HuangShan

(Wuhu Institute of Technology, China, Wuhu, 241003)

**Abstract:** By analogy with Maxwell's equations in electromagnetic form, we can find a group of equations in gravitational form that looks very interesting.

**Key words:** Charge, magnetic monopole, Maxwell equations, gravitational constant.

Maxwell's equations in electromagnetic form are equivalent to,

$$(\mathbf{E}) = \frac{1}{(4\pi)(\epsilon_0)(\mathbf{r})^2} * (\varphi_{\mathbf{B}}) = \frac{(2\pi)(\mathbf{i})^3(\varphi_{\mathbf{E}})^3}{(4\pi)^2(\mathbf{R}_{\infty})^2(\varphi_{\mathbf{B}})^3} * (\varphi_{\mathbf{B}}) ,$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{1}{(\epsilon_0)} * (\varphi_{\mathbf{B}}) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{\partial \mathbf{B}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = 0 , \\ 4, (\nabla \times \mathbf{B}) = (\mu_0) * (\mathbf{J}_{\mathbf{E}}) + \frac{1}{(c)^2} * \frac{\partial \mathbf{E}}{\partial t} , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{1}{(\epsilon_0)} * (\varphi_{\mathbf{B}}) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{1}{(\epsilon_0)} * (\mathbf{J}_{\mathbf{B}}) - \frac{\partial \mathbf{B}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = -(\mu_0) * (\varphi_{\mathbf{E}}) , \\ 4, (\nabla \times \mathbf{B}) = (\mu_0) * (\mathbf{J}_{\mathbf{E}}) + \frac{1}{(c)^2} * \frac{\partial \mathbf{E}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{E}) = (c) * (\mathbf{B}) , (\mathbf{i}) * (\mathbf{J}_{\mathbf{E}}) = (c) * (\mathbf{J}_{\mathbf{B}}) , (\mathbf{i}) * (\varphi_{\mathbf{E}}) = (c) * (\varphi_{\mathbf{B}}) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{(2\pi)(\mathbf{i})^3(\varphi_{\mathbf{E}})^3}{(4\pi)(\mathbf{R}_{\infty})^2(\varphi_{\mathbf{B}})^3} * (\varphi_{\mathbf{B}}) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{(2\pi)(\mathbf{i})^3(\varphi_{\mathbf{E}})^3}{(4\pi)(\mathbf{R}_{\infty})^2(\varphi_{\mathbf{B}})^3} * (\mathbf{J}_{\mathbf{B}}) - \frac{\partial \mathbf{B}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = -\frac{(2\pi)(\mathbf{i})(\varphi_{\mathbf{E}})}{(4\pi)(\mathbf{R}_{\infty})^2(\varphi_{\mathbf{B}})} * (\varphi_{\mathbf{E}}) , \\ 4, (\nabla \times \mathbf{B}) = \frac{(2\pi)(\mathbf{i})(\varphi_{\mathbf{E}})}{(4\pi)(\mathbf{R}_{\infty})^2(\varphi_{\mathbf{B}})} * (\mathbf{J}_{\mathbf{E}}) - \frac{1}{(c)^2} * \frac{\partial \mathbf{E}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{E}) = (c) * (\mathbf{B}) , (\mathbf{i}) * (\mathbf{J}_{\mathbf{E}}) = (c) * (\mathbf{J}_{\mathbf{B}}) , (\mathbf{i}) * (\varphi_{\mathbf{E}}) = (c) * (\varphi_{\mathbf{B}}) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{(\mathbf{i})}{(\varepsilon_0)(c)} * (\varphi_E) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{(\mathbf{i})}{(\varepsilon_0)(c)} * (\mathbf{J}_E) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{E}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = \frac{(\mathbf{i})}{(\varepsilon_0)(c)} * (\varphi_B) , \\ 4, (\nabla \times \mathbf{B}) = -\frac{(\mathbf{i})}{(\varepsilon_0)(c)} * (\mathbf{J}_B) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{B}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{E}) = (c) * (\mathbf{B}) , (\mathbf{i}) * (\mathbf{J}_E) = (c) * (\mathbf{J}_B) , (\mathbf{i}) * (\varphi_E) = (c) * (\varphi_B) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{E}) = \frac{(\mathbf{i})(2\pi)(\mathbf{i})^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\varphi_E) , \\ 2, (\nabla \times \mathbf{E}) = -\frac{(\mathbf{i})(2\pi)(\mathbf{i})^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\mathbf{J}_E) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{E}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{B}) = \frac{(\mathbf{i})(2\pi)(\mathbf{i})^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\varphi_B) , \\ 4, (\nabla \times \mathbf{B}) = -\frac{(\mathbf{i})(2\pi)(\mathbf{i})^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} * (\mathbf{J}_B) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{B}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{E}) = (c) * (\mathbf{B}) , (\mathbf{i}) * (\mathbf{J}_E) = (c) * (\mathbf{J}_B) , (\mathbf{i}) * (\varphi_E) = (c) * (\varphi_B) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, \partial^\alpha \partial_\alpha \mathbf{A}_\beta = -\frac{(\mathbf{i})}{(\varepsilon_0)(c)} \mathbf{J}_\beta , \\ 2, \partial^\alpha \mathbf{A}_\alpha = \frac{(\mathbf{i})}{(\varepsilon_0)(c)(c)^2} \mathbf{J}_\alpha , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, \partial^\alpha \partial_\alpha \mathbf{A}_\beta = -\frac{(\mathbf{i})(2\pi)(\mathbf{i})^2(\varphi_E)^2}{(4\pi)(\mathbf{R}_\infty)^2(\varphi_B)^2} \mathbf{J}_\beta , \\ 2, \partial^\alpha \mathbf{A}_\alpha = \frac{(\mathbf{i})(2\pi)}{(4\pi)(\mathbf{R}_\infty)^2} \mathbf{J}_\alpha , \end{array} \right.$$

Then, by analogy, and considering the relationship between gravity and electromagnetism, the equations in the form of gravity can have,

$$(\mathbf{D}) = \frac{(\mathbf{G}_N)}{(\mathbf{r})^2} * (\varphi_C) = \frac{(4\pi)(\mathbf{a}_0)^2(\mathbf{i})(\varphi_D)(2\pi)}{(\mathbf{r})^2(\varphi_C)} * (\varphi_C) ,$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = (4\pi)(\mathbf{G}_N) * (\varphi_C) , \\ 2, (\nabla \times \mathbf{D}) = -\frac{\partial \mathbf{C}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = 0 , \\ 4, (\nabla \times \mathbf{C}) = \frac{(4\pi)(\mathbf{G}_N)}{(c)^2} * (\mathbf{J}_D) + \frac{1}{(c)^2} * \frac{\partial \mathbf{D}}{\partial t} , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = (4\pi) (\mathbf{G}_N) * (\varphi_C) , \\ 2, (\nabla \times \mathbf{D}) = -(4\pi) (\mathbf{G}_N) * (\mathbf{J}_C) - \frac{\partial \mathbf{C}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = -\frac{(4\pi) (\mathbf{G}_N)}{(c)^2} * (\varphi_D) , \\ 4, (\nabla \times \mathbf{C}) = \frac{(4\pi) (\mathbf{G}_N)}{(c)^2} * (\mathbf{J}_D) + \frac{1}{(c)^2} * \frac{\partial \mathbf{D}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = \frac{(4\pi)^2 (\mathbf{a}_0)^2 (\mathbf{i}) (\varphi_D) (2\pi)}{(\varphi_C)} * (\varphi_C) , \\ 2, (\nabla \times \mathbf{D}) = -\frac{(4\pi)^2 (\mathbf{a}_0)^2 (\mathbf{i}) (\varphi_D) (2\pi)}{(\varphi_C)} * (\mathbf{J}_C) - \frac{\partial \mathbf{C}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = -\frac{(4\pi)^2 (\mathbf{a}_0)^2 (\varphi_C) (2\pi)}{(\mathbf{i}) (\varphi_D)} * (\varphi_D) , \\ 4, (\nabla \times \mathbf{C}) = \frac{(4\pi)^2 (\mathbf{a}_0)^2 (\varphi_C) (2\pi)}{(\mathbf{i}) (\varphi_D)} * (\mathbf{J}_D) + \frac{1}{(c)^2} * \frac{\partial \mathbf{D}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = \frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\varphi_D) , \\ 2, (\nabla \times \mathbf{D}) = -\frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\mathbf{J}_D) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{D}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = \frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\varphi_C) , \\ 4, (\nabla \times \mathbf{C}) = -\frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} * (\mathbf{J}_C) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{C}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, (\nabla \cdot \mathbf{D}) = (\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\varphi_D) , \\ 2, (\nabla \times \mathbf{D}) = -(\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\mathbf{J}_D) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{D}}{\partial t} , \\ 3, (\nabla \cdot \mathbf{C}) = (\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\varphi_C) , \\ 4, (\nabla \times \mathbf{C}) = -(\mathbf{i}) (4\pi)^2 (\mathbf{a}_0)^2 (2\pi) * (\mathbf{J}_C) - \frac{(\mathbf{i})}{(c)} * \frac{\partial \mathbf{C}}{\partial t} , \\ 5, (\mathbf{i}) * (\mathbf{D}) = (c) * (\mathbf{C}) , (\mathbf{i}) * (\mathbf{J}_D) = (c) * (\mathbf{J}_C) , (\mathbf{i}) * (\varphi_D) = (c) * (\varphi_C) , \end{array} \right.$$

$$\Rightarrow \left\{ \begin{array}{l} 1, \partial^\gamma \partial_\gamma \mathbf{A}_\delta = -\frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)} \mathbf{J}_\delta , \\ 2, \partial^\gamma \mathbf{A}_\gamma = \frac{(\mathbf{i}) (4\pi) (\mathbf{G}_N)}{(c)(c)^2} \mathbf{J}_\gamma , \end{array} \right.$$

$$\Rightarrow \begin{cases} 1, \partial^\gamma \partial_\gamma \mathbf{A}_\delta = - \frac{(\mathbf{i})(4\pi)^2 (2\pi)^2 (\mathbf{a}_0)^2}{(2\pi)} \mathbf{J}_\delta , \\ 2, \partial^\gamma \mathbf{A}_\gamma = \frac{(\mathbf{i})(4\pi)^2 (2\pi)^2 (\mathbf{a}_0)^2 (\varphi_C)^2}{(2\pi)(\mathbf{i})^2 (\varphi_D)^2} \mathbf{J}_\gamma , \end{cases}$$

**Reference:** <https://doi.org/10.5281/zenodo.6408584>.